Light emission from the quantum dot core is obtained either by injection or by avalanche electroluminescence (EL).

Injection EL involves a novel approach injecting minority carriers in the core from the wide energy gap n and p-layers, through the cladding layer. In the case of inorganic-organic hybrid device structures, hole blocking layer surrounding the CNCs creates a favorable scenario for efficient injection and recombination taking place in the core of the cladded quantum dots. Avalanche EL device structures are proposed using single crystal, polycrystalline and amorphous starting surfaces. Device structures involving epitaxial layers and non-epitaxial growth are used. The ability to grow cladded nanocrystals (CNCs), pseudomorphically on single crystal substrates is also described. These, in conjunction with dielectric layers grown above and below the quantum dot layer(s), are expected to result in low voltage and high brightness CNC avalanche EL devices.

Variations of the disclosed structures are presented for various material systems. These generic EL devices can be addressed using a variety of conventional display drivers, including active and passive matrix configurations. In the case of avalanche/field emission EL, formation and use of nanotip structure is also presented.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINS

Fig. 1(a) shows the basic structure of conventional cladded nanocrystals, modified at their outer surface with TOPO or TOP.

Fig. 1(b) illustrates a conventional thin-film based EL device.

Fig. 2(a) shows an EL device comprising of pseudomorphic cladded quantum dots sandwiched between thin films of wider energy gap semiconductors.

Fig. 2(b) shows a representative pseudomorphic CNC.

Fig. 3 shows an EL device having multiple layers comprising of pseudomorphic cladded quantum dots sandwiched between epitaxially grown thin films of wider energy gap semiconductors.

Fig. 4 shows a typical white light EL device vertically integrating three primary colors via layers comprising of different pseudomorphic cladded quantum dots whose core size and composition produces the desired color response.